Title: Horsing Around with Horseshoe Crabs

Brief Overview:

Students will use a variety of reading for understanding, research, and mathematical skills to create a brochure illustrating the need for horseshoe crab conservation and preservation in Maryland's Chesapeake Bay area. This unit uses an integration of math and science.

NCTM 2000 Principles for School Mathematics:

- **Equity:** *Excellence in mathematics education requires equity - high expectations and strong support for all students.*
- **Curriculum:** *A curriculum is more than a collection of activities: it must be coherent, focused on important mathematics, and well articulated across the grades.*
- **Teaching:** *Effective mathematics teaching requires understanding what students know and need to learn and then challenging and supporting them to learn it well.*
- **Learning:** *Students must learn mathematics with understanding, actively building new knowledge from experience and prior knowledge.*
- **Assessment:** *Assessment should support the learning of important mathematics and furnish useful information to both teachers and students.*
- **Technology:** *Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning.*

Links to NCTM 2000 Standards:

- **Content Standards**

<u>Number and Operations</u>

- *Understand numbers, ways of representing numbers, relationships among numbers, and number systems; recognize equivalent representations for the same number and generate them by decomposing and composing numbers; develop understanding of fractions as parts of unit wholes, as parts of a collection, as locations on number lines, and as divisions of whole numbers; use models, benchmarks, and equivalent forms to judge the size of fractions; and recognize and generate equivalent forms of commonly used fractions, decimals, and percents.*
- *Understand meanings of operations and how they relate to one another; understand various meanings of multiplication and division; and understand the effects of multiplying and dividing whole numbers.*
- *Compute fluently and make reasonable estimates; develop and use strategies to estimate computations involving fractions and decimals in situations relevant to students' experience; and select appropriate methods and tools for computing with whole numbers from among mental computation, estimation, calculators, and paper and pencil according to the context and nature of the computation and use the selected method or tools.*

Algebra

- *Use mathematical models to represent and understand quantitative relationships; and model problem situations with objects and use representations such as graphs, tables, and equations to draw conclusions.*

Measurement

- *Understand measurable attributes of objects and the units, systems, and processes of measurement; understand such attributes as length, area, weight, volume, and size of angle and select the appropriate type of unit for measuring each attribute; understand the need for measuring with standard units and become familiar with standard units in the customary and metric systems; and understand that measurements are approximations and how differences in units affect precision.*
- *Apply appropriate techniques, tools, and formulas to determine measurements; select and apply appropriate standard units and tools to measure length, area, volume, weight, time, temperature, and the size of angles; and select and use benchmarks to estimate measurements.*

Data Analysis and Probability

- *Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them; design investigations to address a question and consider how data-collection methods affect the nature of the data set; collect data using observations, surveys, and experiments; and represent data using tables and graphs such as line plots, bar graphs, and line graphs.*
- *Develop and evaluate inferences and predictions that are based on data; and propose and justify conclusions and predictions that are based on data and design studies to further investigate the conclusions or predictions.*
- *Understand and apply basic concepts of probability; describe events as likely or unlikely and discuss the degree of likelihood using such words as certain, equally likely, and impossible; predict the probability of outcomes of simple experiments and test the predictions; and understand that the measure of the likelihood of an event can be represented by a number from 0 to 1.*

- **Process Standards**

Problem Solving

- *Instructional programs from prekindergarten through grade 12 should enable all students to build new mathematical knowledge through problem solving; solve problems that arise in mathematics and in other contexts; apply and adapt a variety of appropriate strategies to solve problems; and monitor and reflect on the process of mathematical problem solving.*

Reasoning and Proof

- *Instructional programs from prekindergarten through grade 12 should enable all students to recognize reasoning and proof as fundamental aspects of mathematics; make and investigate mathematical conjectures; develop and evaluate mathematical arguments and proofs; and select and use various types of reasoning and methods of proof.*

Communication

- *Instructional programs from prekindergarten through grade 12 should enable all students to organize and consolidate their mathematical thinking through communication; communicate their mathematical thinking coherently and clearly to peers, teachers, and others; analyze and evaluate the mathematical thinking and strategies of others; Andes the language of mathematics to express mathematical ideas precisely.*

Connections

- *Instructional programs from prekindergarten through grade 12 should enable all students to recognize and use connections among mathematical ideas; understand how mathematical ideas interconnect and build on one another to produce a coherent whole; and recognize and apply mathematics in contexts outside of mathematics.*

Representation

- *Instructional programs from prekindergarten through grade 12 should enable all students to create and use representations to organize, record, and communicate mathematical ideas; select, apply, and translate among mathematical representations to solve problems; Andes representations to model and interpret physical, social, and mathematical phenomena.*

Links to National Science Education Standards:

- **Unifying Concepts and Processes**
  Students will be given the opportunity to work with a model of a horseshoe crab. They will investigate the effect of change within an ecosystem.

- **Science as Inquiry**
  Students will use their observation and inference skills as they are working through this unit. They will need to combine their scientific knowledge and critical thinking skills to determine an outcome. They will have the opportunity to use scientific inquiry; which will include asking questions, conducting investigations, using appropriate tools and techniques to gather data, and thinking logically and critically about relationships.

- **Life Science**
  Students will have the opportunity to explore the size and structure of a horseshoe crab. They will be given the opportunity to learn about the ecosystem that a horseshoe crab is a part of.

- **Science and Technology**
  Students will have the opportunity to create a brochure that will call attention to the plight of the horseshoe crab and present a solution to the problem.

- **Science in Personal and Social Perspectives**
  The students will have an opportunity to understand and act upon a scientific challenge regarding the decline of horseshoe crab populations and the biomedical consequences of their decline.

- **History and Nature of Science**
  Students will have the opportunity to investigate a scientific problem that has been a "hot" topic in the scientific community. The problem has been addressed by legislation, but is at the heart of an ongoing controversy among scientists, fishermen, and other members of the horseshoe crab's ecosystem.

Grade/Level:

Grades 4-5

Duration/Length:

5 days, 50 minute lessons

Prerequisite Knowledge:

Students should have working knowledge of the following skills:

- Estimation
- Basic knowledge of fractions
- Measurement
- Using map scale

Student Outcomes:

Students will:

- learn about the importance of the horseshoe crab.
- work in cooperative groups to gather data.
- represent data as fractions, decimals, and percents.
- refine estimation skills.
- perform a simulation activity to determine probability.
- utilize map skills.
- create an informational brochure.

Materials/Resources/Printed Materials:

- Harry Horseshoe Crab A Tale of Crawly Creatures by Suzanne Tate, ISBN 1-878405-03-9. Published by: Nag's Head Art, Inc. 1-800-541-CRAB http://www.suzannetate.com Also available is Teacher's Guide to Harry Horshoe Crab.
- Teacher Resource Sheets #1 - 8
- Student Resource Sheets #1 - 10
- Horseshoe Crab Models are available for $1.00 from University of Delaware, Marine Communications Office, Newark, DE 19716-3530 (Phone - (302)831-8083)
- 25 rainbow tiles for each student
- Math journals
- Baggies
- BBs (enough for each pair of students to get approximately 100 in their baggie)
- Baby food jars
- Teacher's baby food jar filled with BBs
- Calculators
- Coins (one for each pair of students)
- Chart paper
- Student chosen materials for brochure
- Internet/computer access (optional)
- Transparency film (optional)
- String

Development/Procedures:

Day One

Today, you will introduce the unit that the students will be working on over the next five days.

- Create a K-W-L chart to determine the students' prior knowledge of horseshoe crabs. (See Teacher Resource Sheet #1.)
- Read the book Harry Horseshoe Crab by Suzanne Tate.
- Discuss with students the history of the horseshoe crab. Display the number line/timeline using an overhead of Teacher Resource Sheet #2 to reveal how long horseshoe crabs have been on earth. Compare their lifeline with other living things. For example: dinosaurs, humans. Share with the students that they are moving backwards in time even though the numbers on the timeline are getting larger the further we move to the left on the timeline. Students should become aware that horseshoe crabs have had a lengthy existence. They were on earth long before humans and have remained on earth for a much longer time than the dinosaurs.
- Students will work in cooperative groups with teacher-created horseshoe crab models.
    - Distribute horseshoe crab models to each group of students.
    - Students will work to label diagram of horseshoe crab using word bank provided on the student resource sheet. (Student Resource Sheet #1.) Check answers as a group using Teacher Resource Sheet #3 for correct answers.
    - Measure the female horseshoe crab model and record results on worksheet. (Students will record data on Student Resource Sheet #2.)
    - Explain to students that a male horseshoe crab is 2/3 the size of the female. Based on the measurements they have completed for the female, have them calculate the measurements for a male horseshoe crab.
- Return to the K-W-L chart to record any new information the students have now learned about the horseshoe crab,
- Collect the student worksheets and use the rubric to evaluate student response for completeness of data and time on task. (See Teacher Resource Sheet #4.)

Exemplary completion of worksheet should include:

- correct labeling of body parts
- accurate measurement of female body parts
- reasonable estimate of size of male body parts based on 2/3 the size of the female

Day Two

- The teacher will use whole-class instruction to introduce a map of the east coast of the United States. (See Teacher Resource Sheet #5. It is suggested that the Teacher Resource Sheet be made into a transparency for the overhead.)
- Explain to the students that horseshoe crabs can be found from Maine to Florida.
- Students will use map scale to discover the length of the coastline utilized by the horseshoe crab for habitat and spawning. (Use Student Resource Sheet #3.) Students will place a piece of string along the coastline, pull the string taut, measure the string in inches. They will then convert to miles utilizing the map scale.

- Students will use a map of Maryland to determine the length of the shoreline in the state of Maryland. (Use Student Resource Sheet #4 and Teacher Resource Sheet #6.) The students will repeat using the string as a measurement tool since the coastline is so irregular. **Please note that this will be more difficult than measuring the east coast due to the fact that you must include both sides of the bay area and the eastern shore as well. Also note the change in scale for this map.** How does the shoreline available in Maryland compare to the shoreline of the whole east coast?
- Provide students with a copy of a 5 x 5 grid and 25 rainbow tiles. (Student Resource Sheet #5.) Have students cover each space on the 5 x 5 grid with a tile. Explain to the students that this filled-in grid represents the number of horseshoe crabs there were in a square mile 10 years ago.
    - Have students remove 5 tiles from their grids. Explain to the students that this represents the number of horseshoe crabs in the same square mile 5 years ago. Students are to record data in their math journals as fractions in simplest terms. (Refer to Teacher Resource Sheet #7.) For example, after removing 5 tiles, there are now 20/25 spaces covered. In simplest form, this would be written as 4/5.
    - Have students remove 10 more tiles from their grids. Explain to the students that this represents the number of horseshoe crabs in the same square mile today. Students are to record data in their math journals as fractions in simplest form. This should leave 10/25 spaces covered. In simplest form, this would be 2/5.
- Provide each group of four students with a 10 x 10 grid. (See Student Resource Sheet #6.) Explain to the students that based on the data they have for one square mile, they are to repeat the same activity to figure out how the numbers would proportionately change for an area that is four square miles in size. Students will record their data in their math journals to show area and population change. (See Teacher Resource Sheet #7.) Students should now realize that after 5 years there are 80/100 covered or 4/5. After removing 10 tiles each, there will be 40/100 or 2/5 in simplest form.
- Revisit K-W-L chart with students. Students should realize that the horseshoe crab population has been slowly decreasing over the 10 year period.
- Teacher will use math journals to evaluate student work. (See Teacher Resource Sheet #4.)

  Exemplary work would include:
    - correct fractions to represent the number of crabs at each point in time
    - correct fractions to represent numbers in larger group
    - all fractions are written in simplest form

Day Three

- Students will use estimation skills for the following activity.
- **Please note: In the following activity, we are using BBs (ball bearings). Some teachers might have an issue with using BBs in their classrooms. If that is the case, please substitute a material that would be approximately the same size as a BB when you are doing the activity with your students.**
- Provide each pair of students with a baggie filled with approximately 100 BBs. (Please note that a BB is about the size of one horseshoe crab egg.) The teacher will have a baby food jar filled with BBs. The students' task is to keep refining their estimates in order to reach a conclusion as to how many BBs are in the teacher's baby food jar.
- Students are to use their estimation skills to estimate how many BBs are in the baggie,
    - Students write down their first estimates. (See Student Resource Sheet #7. **Please refer to Teacher Resource Sheet #8 for more specific instructions.**)

- Dump contents of baggie into an empty baby food jar.
- Using their now partially filled baby food jars, students are to make a second estimate as to how many BBs they think are in the teacher's baby food jar.
- Students will now combine the contents of all their baby food jars into one jar. They will now use that jar as a comparison to make a final estimate of the contents of the teacher's baby food jar.

- Students will read handout about the survival rate of horseshoe crab eggs and what affects their survival. (See Student Resource Sheet #8.)
- Survival Rate Calculations (Students should record this information in their math journals.)
  - Each female horseshoe crab lays approximately 20,000 eggs at a time. Each female lays approximately 80,000 eggs per season.
    a. Based on this information, how many times a season does a horseshoe crab lay her eggs? *(4)*
    b. What fractional part of the total number of eggs is laid each time? *(1/4)*
    c. How could you represent this fractional part as a percent? as a decimal? *(25%, .25)*
- Class Calculations
  - Explain to the students that only about 2 horseshoe crabs will grow to adulthood from the 80,000 eggs that are laid by each female. What percent is that survival rate? *(.0025%)*
- Collect the student worksheets and use the rubric to evaluate student work. (See Teacher Resource Sheet #4.)

Exemplary work would include:
- reasonable estimates based on benchmarks being used as reference points
- correct fraction, decimal, and percent based on eggs laid during each season

Day Four

- Explain to students about the plight of hundreds of thousands of horseshoe crabs who die each year after being stuck upside down during their yearly spawning season. Beachgoers are being encouraged to "flip them over" if they come across a "stuck" horseshoe crab. Many people don't realize the importance of the horseshoe crab and walk right past them leaving them in their upside down position.
- In today's activity, students will use tossing a coin to simulate how often they might possibly meet a "flipped" horseshoe crab on the beach. (See Student Resource Sheet #9.)
  - Students will flip a coin one hundred times and indicate on the 10 x 10 grid whether they have "heads" or "tails" as a result of each toss by recording "H" (for heads) or "T" (for tails) in each individual square on the grid.
  - Using the results shown on their grid, student will determine the percentage of probability of flipping "heads" or "tails" and record the results on their worksheets.
  - The teacher will create a class probability chart by compiling the results of each pair of students onto one graph. Did the probability change when all the results were compiled into one chart? *(Elicit from the students that as more trials are added to the class chart, the theoretical probability is more likely to be closer to a 50/50 outcome.)*
- Collect student worksheets and use the rubric to evaluate student work. (See Teacher Resource Sheet #4.)

Exemplary work would include:

- student being focused throughout the probability experiment
- arrival at reasonable percents using the 10 x 10 grid as a tool
- participation in the class discussion on theoretical vs. empirical results

Day Five

- Students will create a public service brochure to aid in the preservation of the horseshoe crab in the Chesapeake Bay area. (See Student Resource Sheet #10.)
- Students can do further research and/or use any of the information they have been provided with during the course of this unit of study.
- Students are encouraged to use the data that they uncovered as they worked through the unit.
- Students should be provided with a copy of the assessment rubric that will be used to evaluate their projects. (See Teacher Resource Sheet #9.)

Performance Assessment:

Your class has been asked to participate in a contest sponsored by the Maryland Department of Natural Resources to design a brochure that will make the public more aware of the need to preserve the horseshoe crab. The students' assignment is to create a brochure to enter in the contest based on the topics that were addressed in class. (See Student Resource Sheet #10.) Evaluation of the completed brochures will be done using a rubric. (See Teacher Resource Sheet #9.)

Extension/Follow Up:

- **"**Raising Horseshoe Crabs in the Classroom**"** is a Maryland Department of Natural Resources program. The project "enables students to become involved in a current marine conservation topic." Teachers receive a teaching packet and all necessary aquarium equipment. After a year, students have an opportunity to release their juvenile crabs into the Chesapeake Bay. Teachers who are interested in participating in the "Raising Horseshoe Crabs in the Classroom" program may contact Matthew Chasse or Cindy Grove at the Maryland Department of Natural Resources. (http://www.dnr.state.md.us/education/teacherslounge/classroom.html)

- For teachers who would like to include a language arts component to this unit of study, there is a yearly writing contest for students sponsored by the horseshoe crab website. (http://www.horseshoecrab.com) Winners from past years are posted on the website.

- After completing brochures, have the students create a KidPix Slide Show to post on the Internet that would alert others to the need for horseshoe crab conservation.

Internet Resources:

Maryland Department of Natural Resources:
http://www.dnr.state.md.us/fisheries/education/horseshoe/horseshoefacts.html
The Assateague Naturalist: http://www.assateague.com/horseshoe.html

Books:

Horseshoe Crab by Robert M. McClung
The Crab that Crawled Out of the Past by Lorus and Margery Milne
The Crab from Yesterday by John F. Waters
Extraordinary Horseshoe Crabs by Julie Dunlap

Authors:

Karen Smith
Saint John Regional Catholic School
Archdiocese of Baltimore, MD

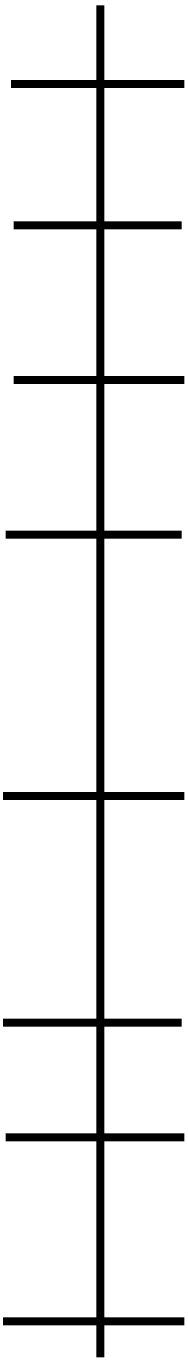
Jill VanSlyke
Holy Family School
Archdiocese of Baltimore, MD

KWL Chart

Horseshoe Crabs

What We *Know* About Them	What We *Want* to Know About Them	What We *Learned* About Them

Historical Information for Use on the Number line/Time line



360,000,000		Horseshoe crabs living in future Maryland area
225,000,000	Permian Period:	Beginning of the dinosaur era
190,000,000	Triassic Period:	First crocodiles
135,000,000	Jurassic Period:	First winged animals First carnivores
65,000,000	Teritery Period:	Extinction of dinosaurs
5,000,000	Pliocene Era:	Primitive man in North America
1,000,000	Pleistocene:	Glaciers begin the ice age
Today		Horseshoe crabs still alive in Maryland

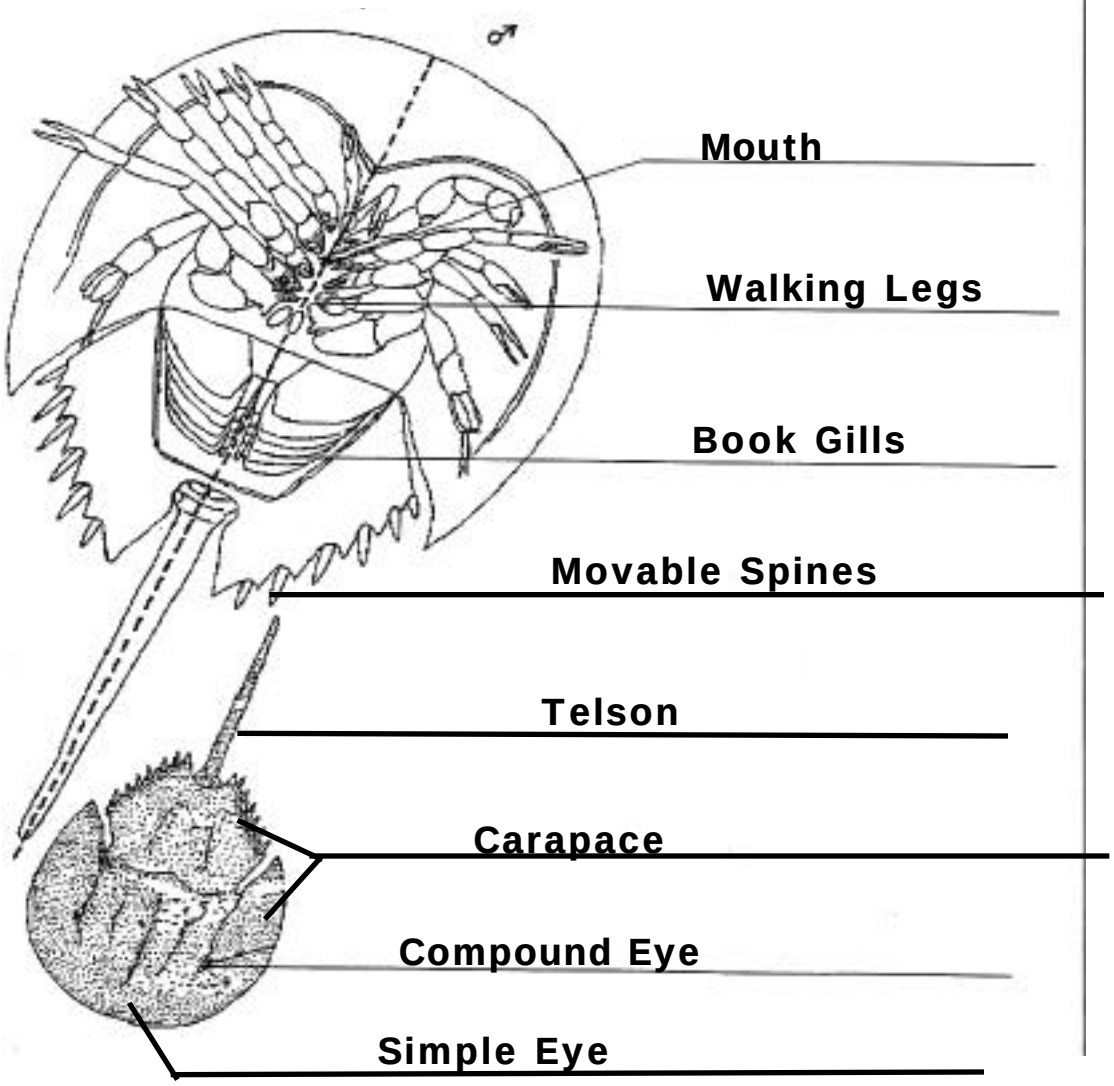
******Year numbers are in "millions of years ago" leading to this year.*******

Timeline adapted from *Maryland Timeline: A Chronology of Our State's History by Carole Marsh*

Answer Key

What is that part?

Directions: Use the terms from the Word Bank to label the various body parts of the horseshoe crab.



Word Bank

Carapace Simple Eye Mouth
Compound Eye Walking LegsTelson
Book Gills Movable Spines

Adapted from Raising Horseshoe Crabs in the Classroom Teacher Packet, Maryland Department of Natural Resources

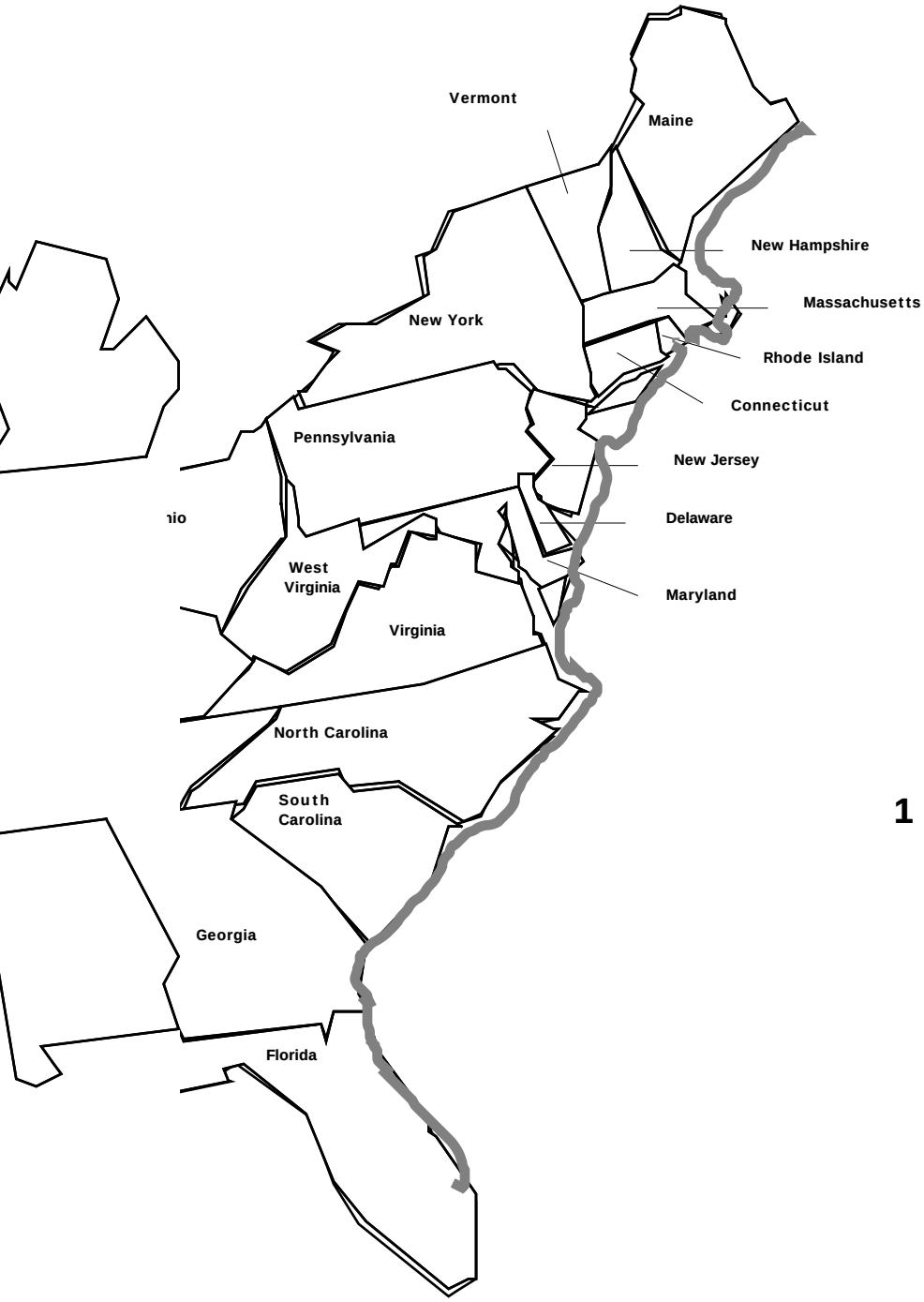
ASSESSMENT RUBRIC

	STUDENT RESPONSE	COMPLETENESS OF DATA	TIME ON TASK
3	Indicates complete understanding of concept.	All data is complete.	Student was appropriately on task.
2	Indicates partial understanding of topic.	Some data is missing.	Student was adequately on task.
1	Indicates minimal understanding of topic.	Data is incomplete.	Student was not adequately on task.

Teacher Resource Sheet #5

Horseshoe Crabs on the Coast

Answer Key



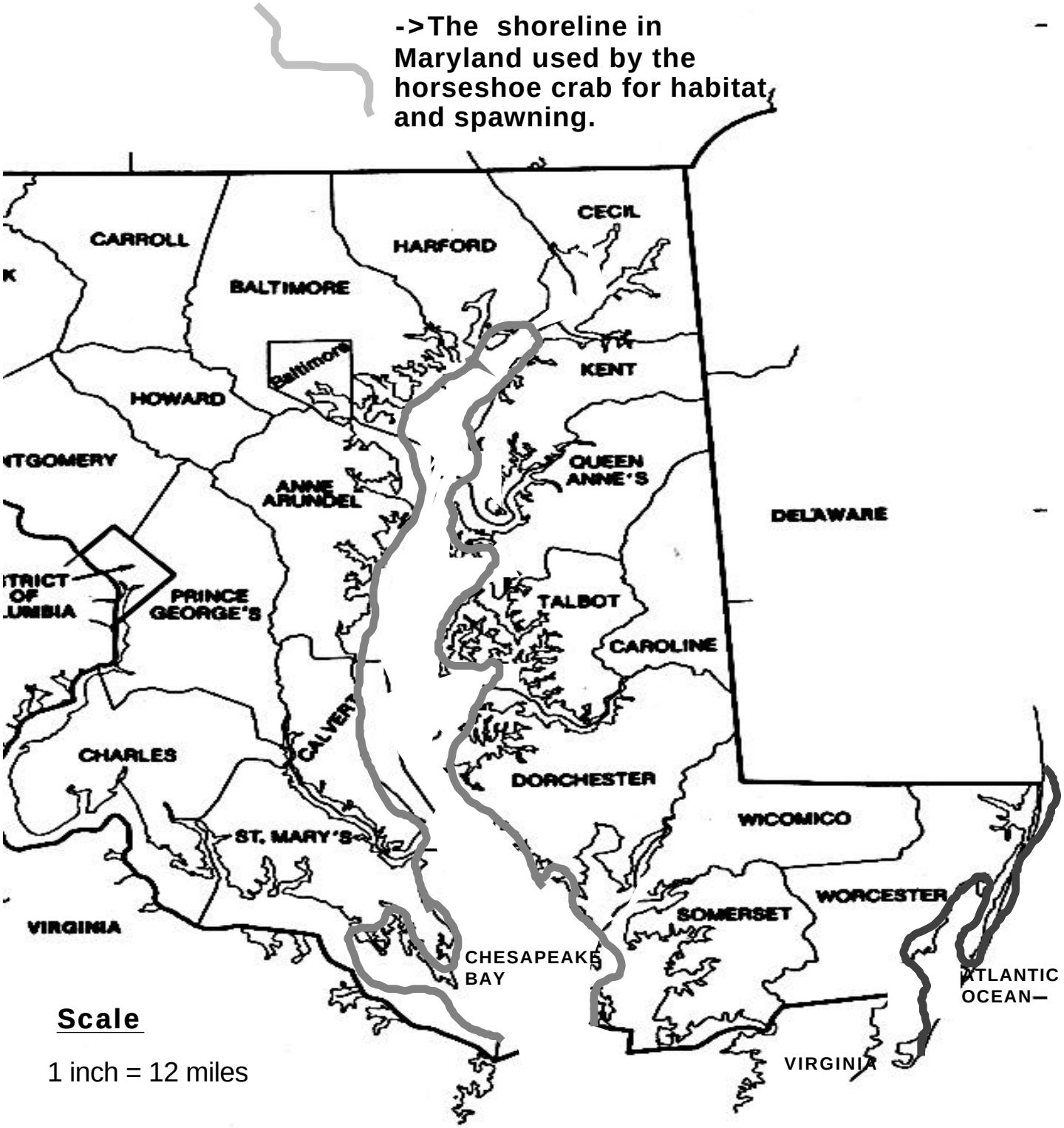
Scale

1 inch = 150 miles

Answer Key

Teacher Resource Sheet #6

Horseshoe Crabs on Maryland's Shore



Answer Keys
for 5x5 Grid & 10x10 Grid Activities

A. 5x5 Grid:

- Student used 25 tiles representing horseshoe crab population of 10 years ago. The fraction for this population is 25/25 OR 1 whole.
- Student took away 5 tiles leaving 20 tiles representing horseshoe crab population of 5 years ago. The fraction of population remaining is 20/25 (simplified to 4/5).
- Student took away 10 tiles leaving 10 tiles representing the horseshoe crab population of today. The fraction of the population remaining from the original year-10 years prior-is 10/25 (simplified to 2/5) ALSO the fraction of the population remaining from the 5 year marker is 10/20 (simplified to 1/2).

B. 10x10 Grid:

- Student will work in groups of four to solve the posed problem.
- 10 X 10 Grid has four 5X 5 Grids in it. Thus, in the original year, there were 100 crabs(tiles) in the area (25 x 4 = 100). This would be the base line OR the "1 whole" from which to begin.
- Five years later, there would be 20 crabs(tiles) in each 5 X 5 Grid OR 80 on the entire 10 X 10 Grid/the 4 Square Mile Area (20 x 4 = 80). The fraction representing this population is 80/100 (simplified to 4/5).
- For the representation of the horseshoe crab population of today in the 4 Square Mile Area, there would be 10 crabs(tiles) in each 5 X 5 Grid OR 40 on the entire 10 X 10 Grid/ the 4 Square Mile Area (10 x 4 = 40). The fraction for this population compared to the original year is 40/100 (simplified to 2/5). ALSO the fraction for this population compared to the five year marker is 40/80 (simplified to 1/2).

- OPTIONAL: As a whole group activity, use the basis of 100 in the original year to display 100% of the Grid was filled. Continue to discuss percentages by observing that in year 5 there was 80% of the Grid filled, then in year 10(today) there was 40% of the Grid filled.

Egg Estimation

Teacher Resource Sheet #8

Teacher Directions:

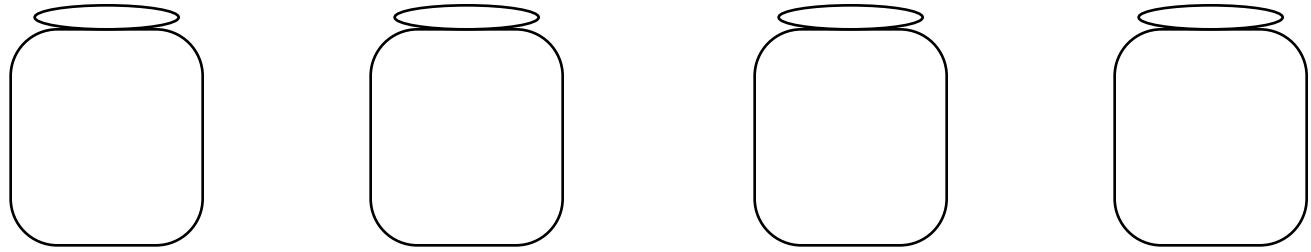
1. Display jar filled with ball bearings(bb) for the class. Explain that the jar is filled with "horseshoe crab eggs." Have each student make an estimate as to the number of eggs in the jar and write that estimate in "Jar of Eggs Estimate #1." Put the jar aside for a while explaining to the students that you are going to find a better way to make your estimations.

2. Distribute a "Bag of Eggs" to each pair of students. Have the students make an estimate of the number of "eggs" in the bag-NO COUNTING!-and record that estimate in the "Bag of Eggs Estimate #1."

3. Instruct each pair-as you demonstrate on the overhead- how to create an "anchor" number to calculate a better estimate.(Place the bag flat on the desk. spread the "eggs" out creating a flat distribution of "eggs." Count out 10 without opening the bag. Move the 10 off to a corner of the bag-this is the "anchor.")Keeping the "anchor eggs" separate from the rest, instruct the students to make a second estimate of the number of eggs in the bag and write that calculation in the "Bag of Eggs Estimate #2."

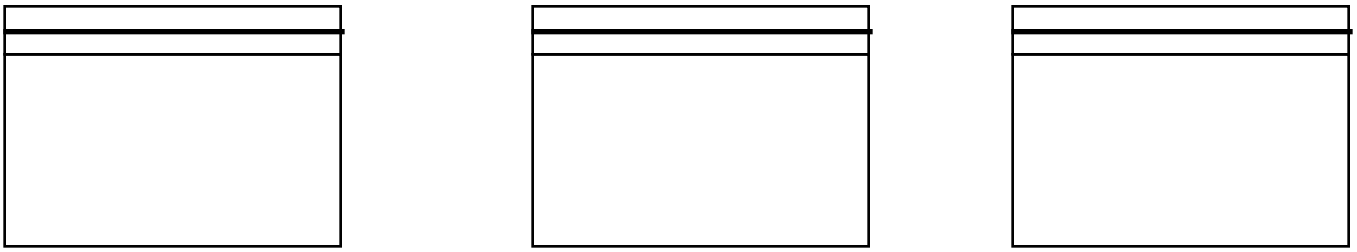
Jar of Eggs

Estimate #1 **Estimate #2** **Estimate #3** **Final Count**



Bag of Eggs

Estimate #1 **Estimate #2** **Final Count**



4. Have each pair count the "eggs" in the bag-DO NOT OPEN THE BAGS!-and record the number of "eggs" in the "Bag of Eggs Final Count."

5. Display a second jar-same size as the filled one, but empty-for the class. Discuss how you could use this jar and the "Bag of Eggs" information to make better estimates for the number of "eggs" in the filled jar.

6. Take one pair's bag and empty it into the empty jar. Display this jar next to the filled one. Instruct the students to calculate another estimate for the filled jar and write that estimate in "Jar of Eggs Estimate #2." (NOTE: Only the teacher should open the bags for safety reasons as well as the incident of the spilling .)

7. Take 2 more bags of "eggs" from 2 more pairs and empty them into the partially filled jar. Using the same format as step 6, have students write their third estimate in "Jar of Eggs Estimate #3."

8. Have volunteers share their estimates. Have students complete the writing portion of the worksheet.

9. Share with the students the total number of "eggs" in the jar-you previously counted-and record that number in "Jar of Eggs Final Count."

Brochure Assessment Rubric

The brochure that the student completed for the competition shows:

3

- **Appropriate construction of a brochure**
- **Accurate data that supports assigned topics**
- **Information presented in a logical format**
- **Information that is persuasive and supported by facts**

2

- **Adequate construction of a brochure**
- **Partially accurate data that supports assigned topics**
- **Information presented in a somewhat logical format**
- **Information that is somewhat supported by facts**

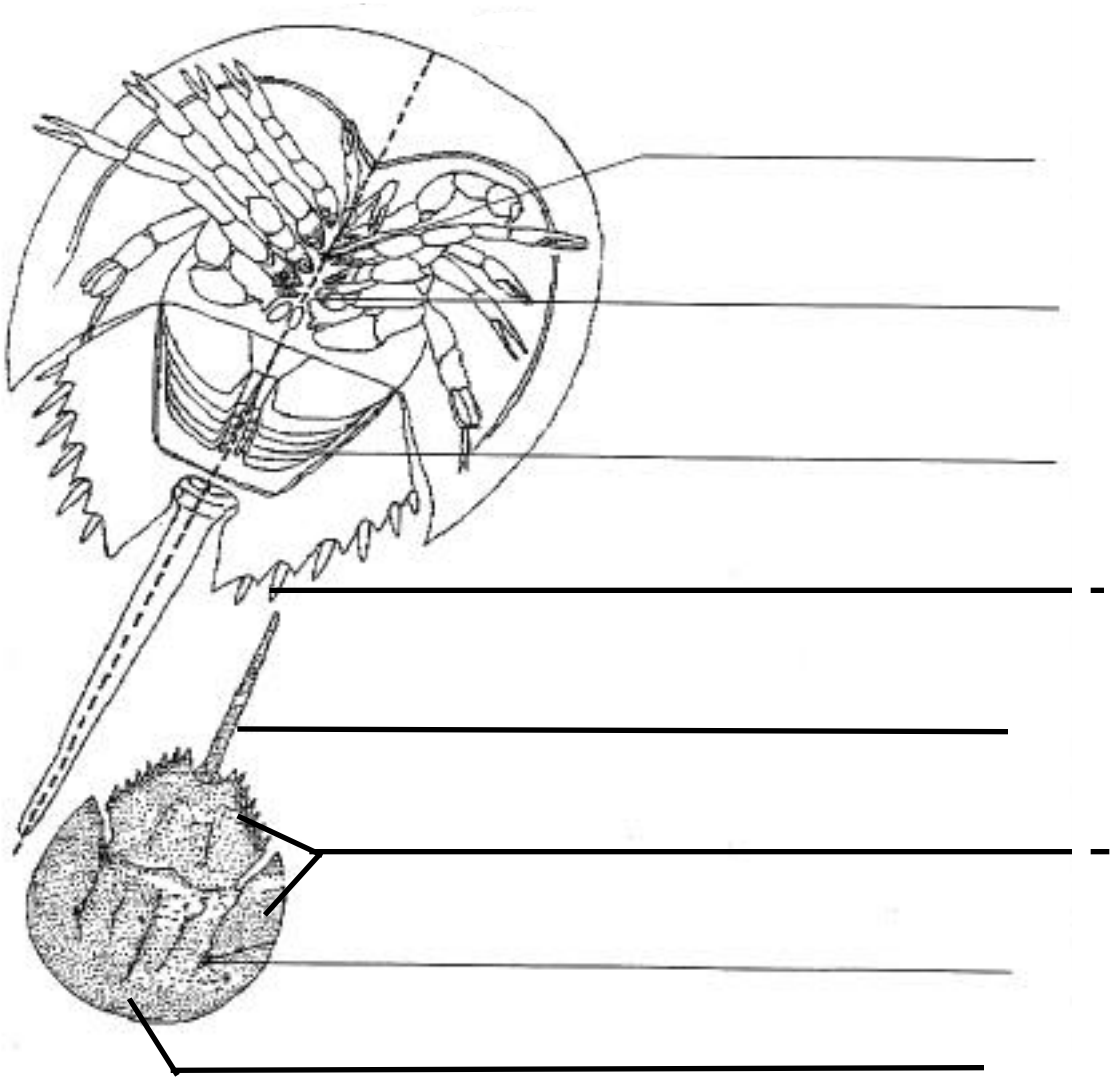
1

- **No brochure constructed**
- **No data included**
- **Information that was assigned is not included**
- **Information that is not supported by facts**

Name _____ Date _____

What is that part?

Directions: Use the terms from the Word Bank to label the various body parts of the horseshoe crab.



Word Bank

Carapace Simple Eye Mouth
Compound Eye Walking Legs Telson
Book Gills Movable Spines

Adapted from Raising Horseshoe Crabs in the Classroom Teacher Packet, Maryland Department of Natural Resources

Measurements of an Average Female and Male Horseshoe Crab

Name _____ Date _____

How Big Are They?

Directions: **1**. Measure your group's horseshoe crab model according to the table below. Record your measurements in centimeters (cm) in the "Female" column.

2. Using the fact ***"Male horseshoe crabs are 2/3 the size of a female."*** estimate the measurements for a male horseshoe crab.

Body Part	Female	Male (Estimated)
Width of Carapace (at widest point)		
Length of Carapace (from Simple Eyes to beginning of Telson)		
Length of Telson (from tip to edge of Carapace)		

Student Resource Sheet #3

Horseshoe Crabs on the Coast

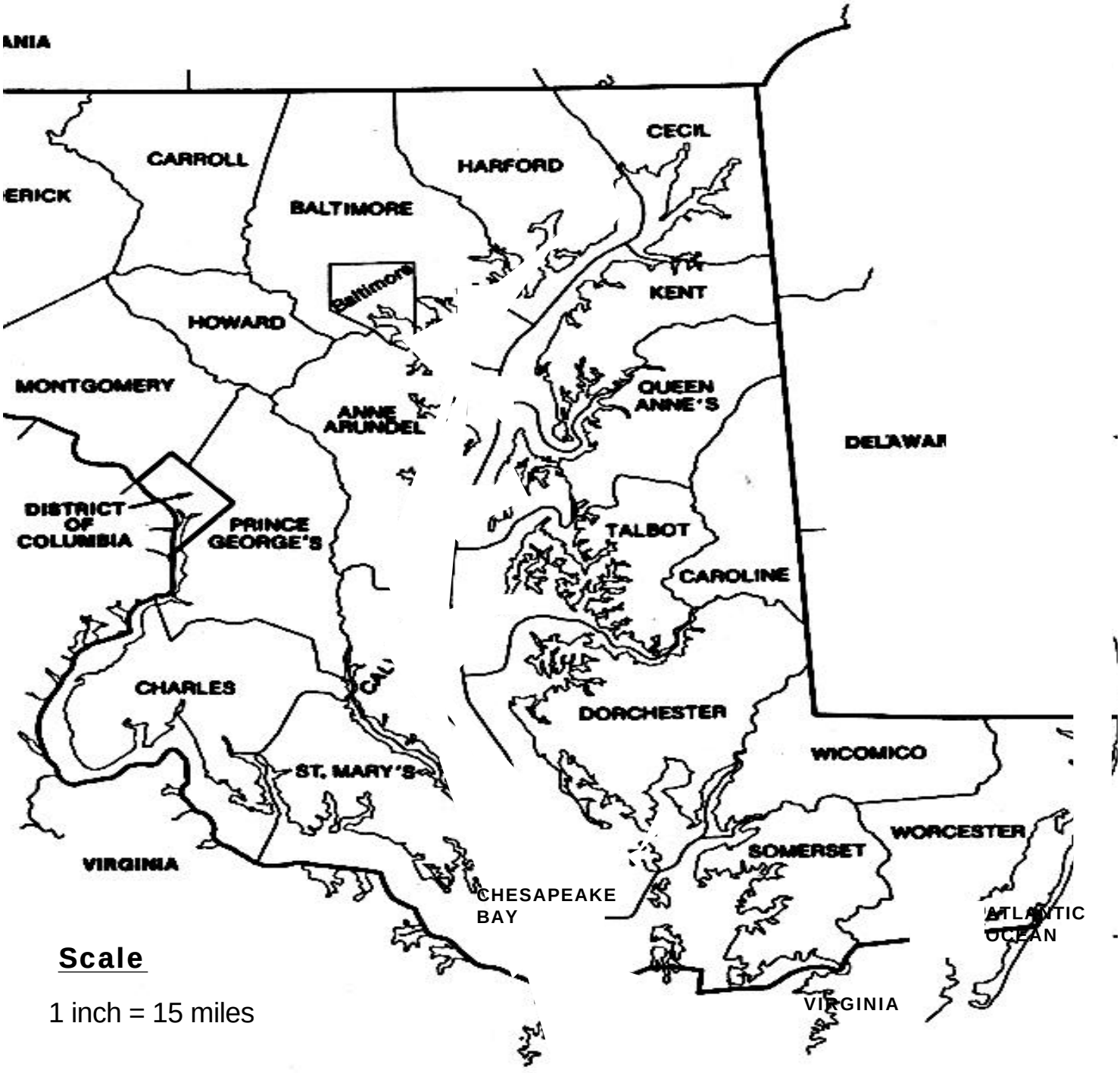
Scale

1 inch = 150 miles

Name _____ Date _____

Name _____ Date _____

Horseshoe Crabs on Maryland's Shore



Scale

1 inch = 15 miles

5x5 Grid

Name _____ Date _____

10x10 Grid

Name _____ Date _____

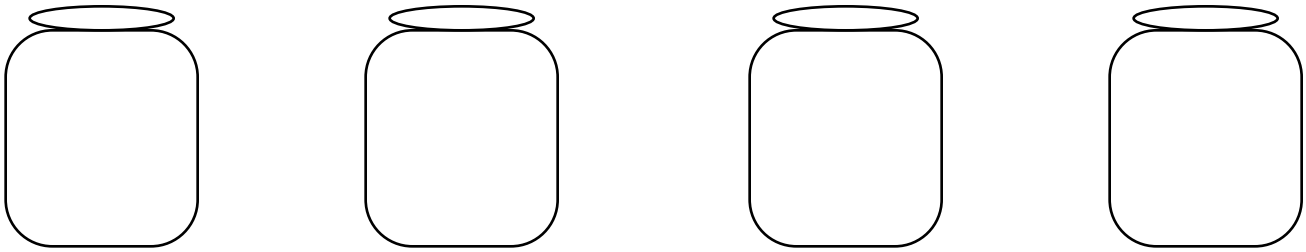
Name _____ Date _____

Egg Estimation

Directions: According to the teacher's directions, write your estimates of the number of "horseshoe crab eggs" below. Record all counted data in the spaces provided. When done, explain in complete sentences why your estimate did or did not change with each activity.

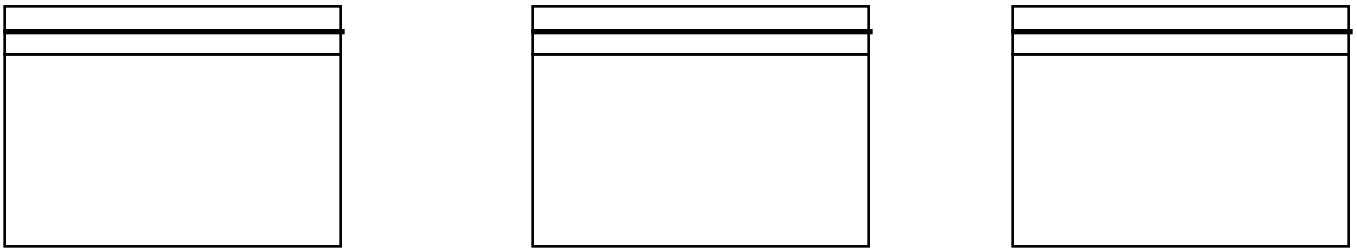
Jar of Eggs

Estimate #1 **Estimate #2** **Estimate #3** **Final Count**



Bag of Eggs

Estimate #1 **Estimate #2** **Final Count**



How Did You Calculate Your Estimates?

Name _____ Date _____

Survival Rate of Horseshoe Crabs

The horseshoe crab is the oldest living fossil in Maryland, having lived here for about 350 million years. Today, horseshoe crabs are important not only to their own ecosystem but also to many human activities and medical research.

Horseshoe crabs reproduce by a process called spawning. In the Chesapeake Bay area, this process usually begins in late May. Female horseshoe crabs like to lay their eggs in areas that are protected by rough waters; such as bays and coves. Females lay about 80,000 eggs in one season. They usually lay a nest of approximately 20,000 clustered eggs. Unfortunately, very few of the thousands of horseshoe crab eggs that are laid each year actually reach maturity.

One reason for this problem is that the horseshoe crab eggs are a food source for birds that migrate along the Atlantic Flyway on their yearly journey from South America to the Arctic. Since these birds need an enormous amount of energy each day, they consume large quantities of horseshoe crab eggs which are readily available on the beaches. Therefore, these birds have an effect on the breeding of horseshoe crabs.

Horseshoe crab eggs are also a food source for a variety of fish species. These include the striped bass, white perch, American eel, and several types of flounder. All crab species also include horseshoe crab eggs in their diets.

In addition to the fact that the eggs are eaten by birds and fish, there are several other factors that effect the survival rate for horseshoe crabs. A horseshoe crab's journey from egg to mature adult takes about ten years. As the horseshoe crab gets older, there are bait harvesters who like to capture female horseshoe crabs who are carrying eggs. Since the horseshoe crab must come to shore to spawn, this makes them more apt to be caught. This also makes it possible for them to become "flipped" which is a fatal mistake for horseshoes.

A decrease in the number of horseshoe crabs may leave many migratory birds without a necessary part of their food chains and will make them unable to complete the trip to their breeding grounds. Adult horseshoe crabs are also a food source for the Atlantic loggerhead turtle, which is already a threatened species in the Chesapeake Bay.

Due to certain chemicals in their blood, horseshoe crabs are a necessity for the biomedical industry that uses their blood to detect toxins. Another substance in their blood is used to detect leukemia. Horseshoe crab blood can also be used to help human blood to clot. For over fifty years, horseshoe crabs have been used in eye research. Since they have large eyes and a large optic nerve that sends signals from the eye to the brain, scientists can learn a lot about how the human eye works by studying the eyes of horseshoe crabs.

The shell of the horseshoe crab contains a substance called chitin. This can be used to produce material that is used to make things like contact lenses, hair spray, and skin cream to name just a few.

As you can see, from egg to adulthood, the horseshoe crab needs our help in its quest for survival because of the many benefits it has to offer us.

Help to Flip

Name _____ Date _____

% of Tails: _____ % of Heads: _____

Name _____ Date _____

Help The Horseshoe Crabs

Your class has been asked to participate in a contest sponsored by the Maryland Department of Natural Resources. The contest announcement states that you need to design a brochure that will develop greater public awareness of the importance of the horseshoe crab in relation to Maryland's environment and economy. Using the information you discovered from our activities as well as any additional research you choose to complete, create a brochure to enter in the statewide contest.